Lloyd's Register

Rules and Regulations for the Classification of Ships, July 2008

Notice No. 1

Effective Date of Latest Amendments:

See page 1

Issue date: August 2008

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RULES AND REGULATIONS FOR THE CLASSIFICATION OF SHIPS, *July 2008*

Notice No. 1

This Notice contains amendments within the following Sections of the *Rules and Regulations for the Classification of Ships, July 2008.* The amendments are effective on the dates shown:

Part	***Chapter***	***Section***	***Effective date***
3	10	2	1 August 2008
4	2	4	Corrigendum
4	7	12	Corrigendum
4	9	9	Corrigendum
5	1	2	1 August 2008
5	2	4	1 August 2008
5	3	3	1 August 2008
5	4	4	1 August 2008
5	5	3	Corrigendum
5	5	4	1 August 2008
5	10	1	1 August 2008
5	11	1	1 August 2008
5	12	2	1 August 2008
5	17	1, 2, 3, 4, 5, 6, 7	1 August 2008
7	9	5, 6	Corrigenda

It will be noted that the amendments also include corrigenda, which are effective from the date of this Notice.

The *Rules and Regulations for the Classification of Ships, July 2008* are to be read in conjunction with this Notice No. 1. The status of the Rules is now:

Rules for Ships	Effective date:	July 2008
Notice No. 1	Effective dates:	1 August 2008 & Corrigenda

Part 3, Chapter 10

Welding and Structural Details

Effective date 1 August 2008

■ *Section 2* Welding

2.1 General

2.1.2 Unless otherwise indicated, all welding is to be in accordance with the requirements of Chapter 13 of the Rules for Materials.

~~2.2 Butt welds~~

2.2.1 Abrupt change of section is to be avoided where plates of different thicknesses are to be butt welded. Where the difference in thickness exceeds 3 mm, the thicker plate to be welded is to be prepared with a taper not exceeding 1 in 3 or with a bevelled edge to form a welded joint proportioned correspondingly. Where the difference in thickness is less than 3 mm the transition may be achieved within the width of the weld. Difference in thickness greater than 3 mm may be accepted provided it can be proven by the Builder, through procedure tests, that the Rule transition shape can be achieved and that the weld profile is such that structural continuity is maintained to the Surveyor's satisfaction.

2.2.2 Where stiffening members are attached by continuous fillet welds and cross completely finished butt or seam welds, these welds are to be made flush in way of the faying surface. Similarly, for butt welds in webs of stiffening members, the butt weld is to be completed and generally made flush with the stiffening member before the fillet weld is made. The ends of the flush portion are to run out smoothly without notches or sudden change of section. Where these conditions cannot be complied with, a scallop is to be arranged in the web of the stiffening member. Scallops are to be of such size, and in such a position, that a satisfactory ~~weld can be made.~~

~~2.3 Lap connections~~

2.3.1 Overlaps are generally not to be used to connect plates which may be subjected to high tensile or compressive loading and alternative arrangements are to be considered. Where, however, plate overlaps are adopted, the width of the overlap is not to exceed four times nor be less than three times the thickness of the thinner plate and the joints are to be positioned as to allow adequate access for completion of sound welds. The faying surfaces of lap joints are to be in close contact and both edges of the overlap are to have ~~continuous fillet welds.~~

~~2.4 Closing plates~~

2.4.1 For the connection of plating to internal webs, where access for welding is not practicable, the closing plating is to be attached by continuous full penetration welds or by slot fillet welds to face plates fitted to the webs. Slots are to have a minimum length of 90 mm and a minimum width of twice the plating thickness, with well rounded ends. Slots cut in plating are to have smooth, clean and square edges and should be spaced not more than 230 mm apart centre to centre. Slots are not to be filled with welding. For rudder ~~closing plates, *see* Ch 13,2.5.6.~~

~~2.5 Stud welding~~

2.5.1 Where permanent or temporary studs are to be attached by welding to main structural parts in areas subject to high stress, the proposed location of the studs and the welding procedures adopted are to be to the satisfaction of ~~the Surveyors.~~

~~2.6~~ 2.2 Fillet welds

~~*2.6.1* T-connections are generally to be made by fillet welds on both sides of the abutting plate, the dimensions and spacing of which are shown in Fig. 10.2.1. Where the connection is highly stressed, deep penetration or full penetration welding may be required. Where full penetration welding is required, the abutting plate may be required to be bevelled.~~

~~*2.6.2*~~ *2.2.1* The throat thickness of fillet welds is to be determined from:

$$\text{Throat thickness} = t_p \times \text{weld factor} \times \frac{d}{s}$$

where

d = the distance between start positions of successive weld fillet, in mm

s = the length, in mm, of correctly proportioned weld fillet, clear of end craters, and is to be not less than 75 mm

t_p = plate thickness, on which weld fillet size is based, in mm

see also Fig. 10.2.1

Weld factors are given in Tables 10.2.1, 10.2.3 and 10.2.4.

~~*2.6.3* Where an approved deep penetration procedure is used, the fillet leg length calculated from the weld factors given in the Tables may be reduced by 15 per cent provided that the Shipyard is able to meet the following requirements:~~

~~(a) Use of a welding consumable approved for deep penetration welding in accordance with Pt 2, Ch 11 for either the 'p' or 'T' techniques.~~

~~(b) Demonstrations by way of production weld testing that the minimum required penetration depths (i.e. throat thicknesses) are maintained. This is to be documented on a monthly basis by the Shipyard, and made available to the Surveyor on request.~~

~~A reduction of 20 per cent may be given provided that in addition to the requirements of (a) and (b) the Shipyard is able to consistently meet the following additional requirements:~~

~~(c) The documentation required in (b) is to be completed and made available to the Surveyor upon request on a weekly basis.~~

~~(d) Suitable process selection confirmed by satisfactory welding procedure tests covering both minimum and maximum root gaps.~~

Existing paragraphs 2.6.4 *to* 2.6.9 *are to be renumbered* 2.2.2 *to* 2.2.7.

~~*2.6.8*~~ *2.2.6* Except as permitted by ~~2.6.7~~ 2.2.5, the throat thickness of the weld is not to be outside the limits specified in Table 10.2.2.

(*Part only shown*)

~~*2.6.9*~~ *2.2.7* Continuous welding is to be adopted in the following locations, and may be used elsewhere if desired:

(h) Where ~~2.6.7~~ 2.2.5 applies.

~~*2.6.10* Where intermittent welding is used, the welding is to be made continuous in way of brackets, lugs and scallops and at the orthogonal connections with other members.~~

Existing paragraph 2.6.11 *has been renumbered* 2.2.8.

Existing sub-Sections 2.7 *and* 2.8 *have been renumbered* 2.3 *and* 2.4.

~~2.9~~ 2.5 Welding equipment

~~*2.9.1*~~ *2.5.1* ~~Welding plant and appliances are to be suitable for the purpose intended and properly maintained taking due cognizance of relevant safety precautions.~~ Welding plant and equipment are to be in accordance with the requirements specified in Ch 13,1.8 of the Rules for Materials.

~~*2.9.2* Satisfactory storage and handling equipment for consumables are to be provided close to working areas.~~

~~*2.9.3* The fabricator is to provide suitable means at the welding area to enable accurate measurement of current and voltage.~~

~~2.10~~ 2.6 Welding consumables and equipment

~~*2.10.1*~~ *2.6.1* ~~All welding consumables are to be approved by Lloyd's Register (hereinafter referred to as 'LR') and are to be suitable for the type of joint and grade of material, *see* Chapter 11 of the Rules for Materials (Part 2).~~ Welding consumables used and associated equipment is to be in accordance with the requirements specified in Ch 13,1.8 of the Rules for Materials.

~~*2.10.2* Special care is to be taken in the distribution,~~ storage and handling of all welding consumables. Prior to use they are to be kept in a heated dry storage area with a relatively uniform temperature. Condensation on the metal surface during storage and use is to be avoided. Flux-coated electrodes and submerged arc fluxes are to be stored under controlled conditions. Other welding consumables, such as bare wire and welding studs, are to be stored under dry conditions to prevent rusting. Prior to use, the welding consumables are to be baked as per the manufacturers' recommendations.

2.10.3 Steel welding consumables approved by LR, up to and including Grade Y40, are considered acceptable for marine construction in line with the following:

(a) Consumables are acceptable for welding steels up to three strength levels below that for which the approval applies (e.g. 3Y is acceptable for welding 36, 32 and 27S higher tensile ship steels and normal strength ship steel).

(b) Consumables with an approved impact toughness grading are acceptable for welding steels with lower specified impact properties subject to (a) (e.g. 3Y is acceptable for EH, DH and AH materials).

(c) For joints between steels of different grades or different strength levels, the welding consumables may be of a type suitable for the lesser grade or strength being connected, provided that due consideration is given to the total load carrying requirement of the joint. The use of a higher grade of welding consumable may be required where attachments are made to main structural members of a higher grade or strength.

2.10.4 Where the carbon equivalent, calculated from the ladle analysis and using the formula given below, is in excess of 0,45 per cent, approved low hydrogen welding consumables and preheating are to be used. Where the carbon equivalent is above 0,41 per cent but is not more than 0,45 per cent, approved low hydrogen welding consumables are to be used, but preheating will not generally be required except under conditions of high restraint or low ambient temperature. Where the carbon equivalent is not more than 0,41 per cent, welding consumables that have no hydrogen grading may be used and preheating will not generally be required except as above.

$$\text{Carbon equivalent} = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

The type of consumable and preheat proposed for low alloy steels will be subject to special consideration.

2.10.5 All aluminium alloy welding consumables are to be approved by LR. The following consumables and material grades apply:

Consumable alloy grade	Base material alloy grade
RA/WA	5754
RB/WB	5086, 5754
RC/WC	5083,5086,5754
~~RD/WD~~	~~6005A, 6061, 6082~~

~~2.11~~ 2.7 Welding procedures and welder qualifications

~~*2.11.1*~~ *2.7.1* ~~Welding procedures, giving details of the welding process, type of consumables, joint preparation and welding position, are to be established for the welding of all joints.~~ Welding procedures are to be established for the welding of all joints in accordance with the requirements specified in Ch 13,1.9 of the Rules for Materials.

~~*2.11.2*~~ *2.7.2* ~~Welding procedures are to be tested and qualified in accordance with a recognized National or International Standard. For this purpose, the sample joints are to be prepared under conditions similar to those that will occur during construction of the ship.~~ All welding procedures are to be tested and qualified in accordance with the requirements of Chapter 12 of the Rules for Materials and are to be approved by the Surveyor prior to construction.

~~*2.11.3*~~ *2.7.3* ~~The proposed welding procedures are to be approved by the Surveyor prior to construction.~~ Welders and welding operators are to be proficient in the type of work to be undertaken and are to be qualified in accordance with the requirements specified in Chapter 12 of the Rules for Materials.

~~*2.11.4* Weld repairs, when required, are to be carried out in accordance with the approved procedures.~~

~~*2.11.5* Welders and welding operators are to be proficient in the type of work on which they are engaged.~~

~~*2.11.6* The responsibility for selection, training and testing of welding operators rests with the Builders. The Builders are to test welding operators to a suitable National or International Standard. Records of tests and qualifications are to be kept by the Builders and made available to the Surveyors so that they can be satisfied that the personnel employed during the construction of the ship can achieve the required standard of workmanship.~~

~~2.12~~ 2.8 Workmanship and shipyard practice

~~*2.12.1*~~ *2.8.1* A sufficient number of skilled supervisors is to be provided to ensure an effective and systematic control at all stages of welding operations.

~~*2.12.2* Where structural components are to be assembled and welded in works sub-contracted by Builders, the Surveyors are to inspect the sub-contractor's works to ensure that compliance with the requirements of this Chapter can be achieved.~~

~~*2.12.3* Structural arrangements are to be such as will allow adequate ventilation and access for preheating, where required, and for the satisfactory completion of all welding operations.~~

~~*2.12.4* The location of welding connections and sequences of welding are to be arranged to minimize restraint. Welded joints are to be so arranged as to facilitate the use of downhand welding wherever possible.~~

~~*2.12.5* All welding is to be carried out in accordance with the approved welding procedure,~~ ~~*see*~~ ~~2.11. The welding arrangements and sequence are to be in accordance with the approved plans and agreed with the Surveyor prior to construction.~~

~~*2.12.6* Careful consideration is to be given to assembly sequence and overall shrinkage of plate panels, assemblies, etc., resulting from welding processes employed. Welding is to proceed systematically with each welded joint being completed in correct sequence without undue interruption. Where practicable, welding is to commence at the centre of a joint and proceed outwards or at the centre of an assembly and progress outwards towards the perimeter so that each part has freedom to move in one or more directions. Generally, the welding of stiffener members, including transverses, frames, girders, etc., to welded plate panels by automatic processes is to be carried out in such a way as to minimize angular distortion of the stiffener.~~

~~*2.12.7* The surfaces of all parts to be welded are to be clean, dry and free from rust, scale and grease. Where manual metal arc welding is used, each run of deposit is to be clean and free from slag before the next run is applied. Before a sealing run, or the first run, is applied to the second side of a full penetration butt weld or T-joint, the root is to be back-chipped, ground or air-arc gouged to sound metal. With other multi-run welding processes, back-gouging may not be necessary, before the first run is applied to the second side. When air-arc gouging is used for this operation, special care is to be taken to ensure that the ensuing groove is slag free and has a profile suitable for the completion of welding.~~

~~*2.12.8* Where prefabrication primers are applied over areas which will be subsequently welded, they are to be of a quality acceptable to LR as having no significant deleterious effect on the finished weld,~~ ~~*see*~~ ~~Ch 2,3.~~

~~*2.12.9* All joints are to be properly aligned and closed or adjusted before welding. Excessive force is not to be used in fairing and closing the work. Where excessive gaps exist between surfaces or edges to be joined, the corrective measures adopted are to be to the satisfaction of the Surveyor. Provision is to be made for retaining correct adjustment during welding operations. Clamps with wedges or strong-backs used for this purpose are to be suitably arranged to allow freedom of lateral movement between adjacent elements. All such temporary fitting aids are to be made from the same type of material as that of the weld joint, e.g. stainless steel with stainless steel.~~

~~*2.12.10* Tack welds are to be kept to the minimum and are to be made in accordance with the approved welding procedure. Tack welds that are to be retained as part of the finished weld are to be clean and free from defects. Care is to be taken when removing tack welds used for assembly to ensure that the material of the structure is not damaged.~~

~~*2.12.11* Generally, tack welds are not to be applied in lengths of less than 30 mm for mild steel grades and aluminium alloys, and 50 mm for higher tensile steel grades.~~

~~*2.12.12* Special attention is to be given to the examination of plating in way of all lifting eye plate positions to ensure freedom from cracks. This examination is not restricted to the positions where eye plates have been removed but includes the positions where lifting eye plates are permanent fixtures.~~

~~*2.12.13* Welded temporary attachments used to aid construction are to be removed carefully by grinding, cutting or chipping. The surface of the material is to be finished smooth by grinding followed by crack detection.~~

~~*2.12.14* Where complete removal of lifting lug attachments~~ is required, it is recommended they be burned off at the top of the fillet weld connections and the remainder chipped and ground smooth. However, alternative methods of removing these attachments will be considered.

2.12.15 Any defects in the structure resulting from the removal of temporary attachments are to be repaired.

2.12.16 When modifications or repairs have been made which result in openings having to be closed by welded inserts, particular care is to be given to the fit of the insert and the welding sequence. The welding is also to be subject to non-destructive examination.

2.12.17 Fairing, by linear or spot heating, to correct distortions due to welding, is to be carried out using approved procedures in order to ensure that the properties of the material are not adversely affected. Visual examination of all heat affected areas and welds in the vicinity is to be carried out to ensure freedom from cracking. The use of spot or line heating to correct distortion is not permitted for aluminium alloys.

2.12.18 All major welding operations that would adversely affect finished machined tolerances are to be complete before the final machining operations on, for example, rudders, sterntubes, propeller brackets and jet units.

2.12.19 Preheating is to be applied in accordance with the approved procedure. When the ambient temperature is below 0°C or where moisture resides on the surfaces to be welded, due care is to be taken to prewarm and dry the joint preparation.

2.12.20 Adequate protection is to be provided where welding is required to be carried out in exposed positions in wet, windy or cold weather.

2.12.21 Special attention is to be paid to preheating when low hydrogen electrodes are used for higher tensile steels on thick materials under high restraint or when applying small weld beads.

2.12.22 Repairs to defective welding are to be carried out using approved welding consumables and procedures. The repair is to be re-examined, *see also* 2.13.19.

2.12.23 Major repairs are not to be carried out without prior approval of the Surveyor.

2.12.24 Repairs to defects found in the base materials during construction are not to be carried out without prior approval of the Surveyor. If repairs are agreed, these are to be carried out in accordance with the requirements of the relevant Section of Part 2, using qualified welding procedures.

2.12.25 When misalignment of structural members either side of bulkheads, decks etc., exceeds the agreed tolerance, the misaligned item is to be released, realigned and rewelded ~~in accordance with an approved weld procedure.~~

~~*2.12.26* Where welding of aluminium alloy is employed, the~~ following additional requirements are to be complied with, if applicable:

(a) The aluminium alloys are to be welded by the metal inert gas or tungsten inert gas processes. Where it is proposed to use other welding processes, details are to be submitted for approval.

(b) The edges of the material to be welded are to be clean and free from grease by chemical or solvent cleaning. The joint edges are to be scratch-brushed, preferably immediately before welding, in order to remove oxide or ~~adhering films of dirt, fillings, etc.~~

~~2.13~~ 2.9 Inspection of welds

~~*2.13.1*~~ *2.9.1* Effective arrangements are to be provided by the Shipbuilder for the ~~visual~~ inspection of finished welds to ensure that all welding has been satisfactorily completed.

~~*2.13.2*~~ *2.9.2* ~~All finished welds are to be sound and free from cracks and lack of fusion and substantially free from incomplete penetration, porosity and slag. The surfaces of welds are to be reasonably smooth and substantially free from undercut and overlap. Care is to be taken to ensure that the specified dimensions of welds have been achieved and that both excessive reinforcement and under fill of welds are avoided.~~ All finished welds are to be subjected to non-destructive examination in accordance with the requirements specified in Ch 13,2.12 of the Rules for Materials.

~~*2.13.3* Welds are to be clean and free from paint at the~~ time of visual inspection.

2.13.4 Welds may be coated with a thin layer of protective primer prior to inspection provided it does not interfere with inspection and is removed, if required by the Surveyor, for closer interpretation of possible defective areas.

2.13.5 Visual inspection of all welds may be supplemented by other non-destructive examination techniques in cases of unclear interpretation, as considered necessary by the Surveyor.

2.13.6 In addition to visual inspection, welded joints are to be examined using any one or a combination of ultrasonic, radiographic, magnetic particle, eddy current, dye penetrant or other acceptable methods appropriate to the configuration of the weld.

2.13.7 The method to be used for the volumetric examinations of welds is the responsibility of the Shipbuilder. Radiography using x-rays is generally preferred for the examination of butt welds of 10 mm thickness or less. Ultrasonic examination is acceptable for welds of 10 mm thickness or greater and is to be used for the examination of full penetration, tee butt or cruciform welds or joints of similar configuration. Where ultrasonic inspection of welds below 10 mm in thickness is proposed, this will be specially ~~considered by LR NDE.~~

~~*2.13.8* Non-destructive examinations are to be made in accordance with definitive written procedures prepared in accordance with a nationally or internationally recognised standard and authorised by Level III qualified personnel. As a minimum, procedures are to identify personnel qualification levels required, NDE datum and identification system, the extent of testing, NDE methods to be applied with technique sheets, acceptance criteria to be applied and the reporting requirements. All NDE procedures are to be approved by a surveyor prior to beginning examination.~~

~~*2.13.9* Non-destructive examinations are to be undertaken by personnel qualified to an appropriate level of a certification scheme recognized by LR, such as those based on the requirements of ISO 9712, EN 473 or SNT-TC-1A. Generally, inspection personnel subject to direct supervision are to be qualified to Level I; where personnel are unsupervised, they are required to be qualified to Level II or Level III as appropriate. Qualification schemes for Level I and II personnel are to include assessment of practical ability where examinations are to be made on representative test pieces containing relevant defects. The results of qualification tests are to be made available upon request.~~

~~*2.13.10* Checkpoints examined at the pre-fabrication stage are to include ultrasonic testing on examples of the stop/start points of automatic welding and magnetic particle inspections of weld ends.~~

~~*2.13.11* Checkpoints examined at the construction stage are generally to be selected from those welds intended to be examined as part of the agreed quality control programme to be applied by the Shipbuilder. The locations and numbers of checkpoints are to be agreed between the Shipbuilder and the Surveyor.~~

~~*2.13.12* Where components of the structure are sub-contracted for fabrication, the same inspection regime is to be applied as if the item had been constructed within the shipyard. In these cases, particular attention is to be given to highly loaded fabrications (such as stabilizer fin boxes) forming an integral part of the hull envelope.~~

~~*2.13.13* Particular attention is to be paid to highly stressed items. Magnetic particle inspection is to be used at ends of fillet welds, T-joints, joints or crossings in main structural members and at sternframe connections.~~

~~*2.13.14* Checkpoints for volumetric examination are to be selected so that a representative sample of welding is examined.~~

~~*2.13.15*~~ *2.9.3* Typical locations for volumetric examination and number of checkpoints to be taken are shown in Table 10.2.6. Critical locations as identified by ShipRight FDA Procedure (*see* Chapter 16) will also be considered. A list of the proposed items to be examined is to be submitted for approval.

~~*2.13.16* In addition, the following non-destructive examination is to be carried out on ships to be assigned the class notation 'Chemical tanker':~~

(a) ~~All crossings of butts and seams of cargo tank bulkhead plating joint welded in assembly areas or on the berth.~~

(b) ~~Where cargo tank boundary welding is completed in assembly areas or on the berth, a minimum of 10 per cent of the total weld length is to be crack detected.~~

(c) ~~Where side and bottom longitudinal framing and longitudinal stiffeners terminate at transverse bulkheads, a minimum of 10 per cent of the bulkhead boundary connections is to be crack detected in addition to the requirement given in (b).~~

(d) ~~Where longitudinal framing and longitudinal bulkhead stiffeners are continuous through transverse bulkheads, 30 per cent each of the bottom and shipside boundaries and 20 per cent of the longitudinal bulkhead boundaries are to be crack detected in addition to the requirement given in (b).~~

(e) ~~Where transverse framing members are continuous through the cargo tank boundary, a minimum of 10 per cent of boundary connections is to be crack detected.~~

~~*2.13.17* For the hull structure of refrigerated spaces, and of ships designed to operate in low air temperatures, the extent of non-destructive examination will be specially considered. For non-destructive examination of gas ships *see* the *Rules for Liquefied Gases.*~~

~~*2.13.18* For all ship types, the Shipbuilder is to carry out random non-destructive examination at the request of the Surveyor.~~

~~*2.13.19* The full extent of any weld defect is to be ascertained by applying additional non-destructive examinations where required. Unacceptable defects are to be completely removed and where necessary, re-welded. The repair is to be examined after re-welding.~~

~~*2.13.20* Results of non-destructive examinations made during construction are to be recorded and evaluated by the Shipbuilder on a continual basis in order that the quality of welding can be monitored. These records are to be made available to the Surveyors.~~

~~*2.13.21* The extent of applied non-destructive examinations is to be increased when warranted by the analysis of previous results.~~

Part 4, Chapter 2

Ferries, Roll on-Roll off Ships and Passenger Ships

CORRIGENDUM

■ *Section 4*
Shell envelope plating

4.2 Bow flare and wave impact pressures

(*Part only shown*)
4.2.1 The bow flare wave impact pressure and wave impact pressure on other parts of the side shell plating close to and above the design waterline, P_{bf} , in kN/m^2 due to relative motion is to be taken as:

~~x~~ X_{wL} = longitudinal distance, in metres, measured forwards from the aft end of the L_{WL} to the location being considered

Part 4, Chapter 7

Bulk Carriers

CORRIGENDUM

■ *Section 12*
Steel hatch covers

12.5 Allowable stress

Table 7.12.2 Permissible stresses

Failure mode	Permissible stress, in N/mm^2 (kgf/mm^2)
Bending	σ_a = $0,80\sigma_F$
Shear	τ_a = ~~0,45~~ $0,46\sigma_F$
Symbols	
σ_F = minimum upper yield stress, in N/mm^2 (kgf/mm^2)	

Part 4, Chapter 9

Double Hull Oil Tankers

CORRIGENDUM

■ *Section 9*
Primary members supporting longitudinal framing

9.1 General

9.1.3 The scantlings of primary members are, in general, to be determined from direct calculations carried out in accordance with the requirements of Section 14 or in accordance with the requirements of this Section or the relevant Sections of Chapter 10. The direct calculations are to be submitted with the plans for confirmatory purposes, *see also* ~~1.1.9~~ 1.4.5.

Part 5, Chapter 1

General Requirements for the Design and Construction of Machinery

Effective date 1 August 2008

■ *Section 2*
Plans and particulars

2.3 Welding

2.3.1 Welding consumables, plant and equipment are to be in accordance with the requirements specified in Ch 13,1.8 of the Rules for Materials.

2.3.2 Welding procedures and welder qualifications are to be tested and qualified in accordance with the requirements specified in Chapter 12 of the Rules for Materials.

2.3.3 Production weld tests are to be carried out where specified in the subsequent chapters of these Rules.

2.3.4 All finished welds are to be subjected to non-destructive examination in accordance with the requirements specified in Ch 13,2.12 of the Rules for Materials and or the requirements specified in the subsequent chapters of these Rules.

Part 5, Chapter 2

Oil Engines

Effective date 1 August 2008

■ *Section 4*
Construction and welded structures

4.3 Materials and construction

4.3.2 ~~Plates and weld preparations are to be accurately machined or flame cut to shape. Flame cut surfaces are to be cleaned by machining or grinding: if the flame cut surfaces are smooth, wire brushing may be accepted.~~ Welding is to be carried out in accordance with the requirements of Chapter 13 of the Rules for Materials, using welding procedures and welders that have been qualified in accordance with Chapter 12 of the Rules for Materials.

4.5 Inspection

4.5.2 ~~On completion of welding and stress relief heat treatment, all welds are to be examined.~~ Inspection of welds is to be in accordance with the requirements of Ch 13,1.11 of the Rules for Materials.

Part 5, Chapter 3

Steam Turbines

Effective date 1 August 2008

■ *Section 3*
Design and construction

3.2 Welded components

3.2.2 Welding is to be carried out in accordance with the requirements of Ch 13,4 of the Rules for Materials using welding procedures and welders that have been qualified in accordance with Chapter 12 of the Rules for Materials.

Existing paragraphs 3.2.2 *to* 3.2.7 *have been renumbered* 3.2.3 *to* 3.2.8*.*

~~*3.2.8* The heat treatment of welded rotors is to be carried out as approved.~~

3.2.9 ~~Surveyors are to be satisfied that the desired quality of welding is attainable with the proposed welding equipment and procedure and, for this purpose, test specimens representative of the welded joints are to be provided for radiographic examination and mechanical tests.~~ For all welded components, weld procedure tests are to be in accordance with Ch 12,2.7 of the Rules for Materials.

~~*3.2.10* For cylinders, the mechanical tests of butt joints are to include tensile, bend and macro tests as detailed in Chapter 17, Sections 1 to 8.~~

~~*3.2.11* For diaphragms, nozzle plates, etc., representative samples are to be sectioned and macro-etched.~~

~~*3.2.12* For rotors, the mechanical tests are to include tensile (all weld metal), tensile (joint), bend (transverse), bend (longitudinal) and macro tests as detailed in Chapter 17, Sections 1 to 8, or such other tests as may be approved.~~

~~*3.2.13*~~ *3.2.10* ~~In subsequent production, check tests of the quality of the welding are to be carried out at the discretion of the Surveyors.~~ Production weld tests are to be performed according to the requirements of Ch 13,4.5 of the Rules for Materials.

Part 5, Chapter 4

Gas Turbines

Effective date 1 August 2008

■ *Section 4*
Design and construction

4.9 Welded construction

4.9.1 ~~Full strength welds are to be used for all major joints and be designed so as to ensure complete fusion of the joint.~~ Welding is to be carried out in accordance with the requirements of Chapter 13 of the Rules for Materials, using welding procedures and welders that have been qualified in accordance with Chapter 12 of the Rules for Materials.

Part 5, Chapter 5
Gearing

CORRIGENDUM

■ *Section 3*
Design

3.5 Tooth loading for bending stress

(*Part only shown*)
3.5.2 Tooth form factor, Y_F:

where h_F, $\alpha_{F\,en}$ and S_{Fn} are shown in Fig. 5.3.1.

$$\frac{S_{Fn}}{m_n} = \cancel{zn}\, z_n \sin\left(\frac{\pi}{3} - \nu\right) + \sqrt{3}\left(\frac{G}{\cos\nu} - \frac{\rho_{ao}}{m_n}\right)$$

where

Effective date 1 August 2008

■ *Section 4*
Construction

4.3 Gearcases

~~*4.3.3* The welding is to be carried out in positions free from draughts and is to be downhand (flat) wherever practicable. Welding consumables are to be suitable for the materials being joined.~~

Existing paragraphs 4.3.4 *and* 4.3.5 *have been renumbered* 4.3.3 *and* 4.3.4.

Part 5, Chapter 10
Steam Raising Plant and Associated Pressure Vessels

Effective date 1 August 2008

■ *Section 1*
General requirements

1.5 Classification of fusion welded pressure vessels

1.5.6 ~~Heat treatment, non-destructive examinations and routine tests, where required, for the three classes of fusion welded pressure vessels are indicated in Table 10.1.1. Details are given in Chapter 17.~~ Details of heat treatment, non-destructive examination and routine tests (where required) are given in Chapter 13 of the Rules for Materials.

1.5.7 Hydraulic testing is required for pressure vessels of Class 1, 2/1 and 2/2.

~~**Table 10.1.1 Heat treatment, non-destructive examination and testing requirements**~~

Class	Radiographic examination	Heat treatment	Routine weld tests	Hydraulic test
1	Required, *see* Chapter 17	*See* Chapter 17	Required	Required
2/1	Spot required, *see* Chapter 17	*See* Chapter 17	Required	Required
2/2	—	*See* Chapter 17	Required	Required

Part 5, Chapter 11
Other Pressure Vessels

Effective date 1 August 2008

■ *Section 1*
General requirements

1.5 Classification of fusion welded pressure vessels

1.5.7 ~~Heat treatment, non-destructive and routine tests where required, for the four Classes of fusion welded pressure vessel are indicated in Table 11.1.1. Details of these requirements are given in Chapter 17.~~ Details of heat treatment, non-destructive examination and routine tests (where required) are given in Chapter 13 of the Rules for Materials.

1.5.8 Hydraulic testing is required for all Classes of pressure vessels.

~~*1.5.8*~~ *1.5.9* For a full definition of Classes of pressure vessels relating to boilers and associated pressure vessels, *see* Ch 10,1.

~~**Table 11.1.1 Heat treatment, non-destructive examination and testing requirements**~~

Class	Radiographic examination	Heat treatment	Routine weld tests	Hydraulic test
1	Required *see* Chapter 17	*see* Chapter 17	Required	Required
2/1	Spot required *see* Chapter 17	*see* Chapter 17	Required	Required
2/2	—	*see* Chapter17	Required	Required
3	—	—	—	Required

Part 5, Chapter 12
Piping Design Requirements

Effective date 1 August 2008

■ *Section 2*
Carbon and low alloy steels

2.6 Welded-on flanges, butt welded joints and fabricated branch pieces

2.6.3 Butt welded joints are generally to be of the full penetration type and are to meet the requirements of ~~Chapter 17~~ Chapter 13 of the Rules for Materials.

2.13 Non-destructive testing

2.13.1 For details of non-destructive tests on piping systems, other than hydraulic tests, *see* ~~Chapter 17~~ Chapter 13 of the Rules for Materials.

Part 5, Chapter 17

Requirements for Fusion Welding of Pressure Vessels and Piping

Effective date 1 August 2008

■ *Section 1*
General

1.1 Scope

~~*1.1.3* The term 'fusion weld', for the purpose of these requirements, is applicable to welded joints made by manual, semi-automatic or automatic electric arc welding processes. Special consideration will be given to the proposed use of other fusion welding processes, *see* Section 6 for oxy-acetylene welding of pipes.~~

Existing paragraph 1.1.4 *has been renumbered* 1.1.3.

1.2 General requirements for welding plant and welding quality

1.2.1 In the first instance, and before work is commenced, the Surveyors are to be satisfied that the required quality of welding is attainable with the proposed welding plant, equipment and procedures in accordance with the guidelines specified in *Materials and Qualification Procedures for Ships Book A, Procedure 0-4*.

~~*1.2.2* The procedures are to include the regular systematic supervision of all welding, and the welders are to be subjected by the work's supervisors to periodic tests for quality of workmanship. Records of these tests are to be kept and are to be available for inspection by the Surveyors.~~

~~*1.2.3*~~ *1.2.2* All welding is to be ~~to the satisfaction of the Surveyors~~ in accordance with the requirements specified in Chapter 13 of the Rules for Materials.

1.3 Manufacture and workmanship of fusion welded pressure vessels

1.3.1 Pressure vessels are to be constructed and examined in accordance with the requirements specified in Chapter 13 of the Rules for Materials, unless more stringent requirements are specified.

■ *Section 2*
Manufacture and workmanship of fusion welded pressure vessels

2.2 Materials of construction

~~*2.2.1* Materials used in welded construction are to be readily weldable and shall have proven weldability.~~

~~*2.2.2* Materials are to be supplied by firms that have been approved in accordance with the *Rules for the Manufacture, Testing and Certification of Materials* (hereinafter referred to as the Rules for Materials).~~

~~*2.2.3* Where the construction details are such that materials are subject to through thickness strains, consideration should be given to using materials with specified through thickness properties as specified in Ch 3,8 of the Rules for Materials).~~

~~*2.2.4*~~ *2.2.1* Where the construction requires post weld heat treatment, consideration should be given to certifying the material after subjecting the test pieces to a simulated heat treatment.

~~*2.2.5* The identity of materials is to be established by way of markings, etc., so that traceability to the original manufacturer's certificate is maintained.~~

Sub-Sections 2.3, 2.4, 2.5 *and* 2.6 *have been deleted.*

Existing sub-Section 2.7 *has been renumbered* 2.3.

~~■ *Section 3*~~
~~Routine weld tests for pressure vessels~~

Existing **Section 3** *has been deleted.*

■ *Section ~~4~~ 3*
Repairs to welds on fusion welded pressure vessels

Existing **Section 4** *has been renumbered* **Section 3***.*

~~4.1~~ 3.1 General

~~*4.1.1*~~ *3.1.1* ~~Where non-destructive examinations reveal unacceptable defects in the welded seams, they are to be repaired in accordance with the following:~~ Repairs to welds on fusion welded pressure vessels are to be in accordance with the requirements of Chapter 13 of the Rules for Materials.

- ~~(a) Major repairs shall not be carried out without the prior consent of the Surveyors.~~
- ~~(b) Where cracks have developed as a result of welding, these are to be reported to the Surveyors and the cause established prior to undertaking weld repair.~~
- ~~(c) Defects may be removed by grinding, chipping or thermal gouging. Where thermal gouging is used, the repair groove shall be subsequently ground to remove oxides and debris. In all cases, the groove shall have a profile suitable for welding.~~

~~(d) Prior to commencing repair welding, confirmation that the original defect has been removed is required by performing visual examination. This may be augmented by surface crack detection examination at the discretion of the Surveyors.~~

~~(e) Repair welding is to be performed using welding procedures agreed with the Surveyors.~~

~~(f) Where the pressure vessel requires post weld heat treatment in accordance with Section 5, this shall be performed after completion of the weld repairs.~~

~~(g) Weld repairs are to be shown by further non-destructive examinations to have removed the defect to the Surveyor's satisfaction.~~

~~(g) Weld repairs are to be shown by further non-destructive examinations to have removed the defect to the Surveyor's satisfaction.~~

~~4.2~~ ~~Re-repairs~~

~~*4.2.1* In general, only two repair attempts are to be made of the same defect. Any subsequent repairs will be at the discretion of the Surveyors and may require the removal of the heat affected zone of the original repair.~~

Section ~~5~~ 4

Post-weld heat treatment of pressure vessels

Existing **Section 5** *has been renumbered* **Section 4***.*

~~5.1~~ 4.1 General

~~*5.1.1*~~ *4.1.1* ~~Fusion welded pressure vessels, where indicated in Table 17.5.1 are to be heat treated on completion of the welding of the seams and of all attachments to the shell and ends, and before the hydraulic test is carried out.~~ Post-weld heat treatment of fusion welded pressure vessels are to be in accordance with the requirements of Chapter 13 of the Rules for Materials.

~~*5.1.2* Tubes which have been expanded into headers or~~ drums may be seal welded without further post weld heat treatment.

5.1.3 Where the weld connects parts of different thicknesses, the thickness to be used when applying the requirements for post weld heat treatment is to be either the thinner of the two plates for butt welded connections, or the thickness of the shell for connections to flanges, tubeplates and similar connections.

5.1.4 Parts are to be properly prepared for heat treatment, sufficient temporary supports are to be provided to prevent undue distortion or collapse of the structure and any machined faces are to be adequately protected against scaling.

5.1.5 Care is to be exercised to provide drilled holes in double reinforcing plates and other closed spaces prior to ~~heat treatment.~~

Table 17.5.1 *has been deleted.*

Table 17.5.2 *has been deleted.*

~~5.2~~ ~~Basic requirements for heat treatment of fusion welded pressure vessels~~

Existing sub-Section 5.2 *has been deleted*.

Section ~~6~~ 5

Welded pressure pipes

Existing **Section 6** *has been renumbered* **Section 5***.*

~~6.1~~ 5.1 General

~~*6.1.1*~~ *5.1.1* ~~Fabrication of pipework is to be carried out in accordance with the requirements of this section unless other more stringent requirements have been specified.~~ Fabrication of pipework is to be carried out in accordance with the requirements of Ch 13,5 of the Rules for Materials.

Table 17.6.1 *has been deleted*.

Table 17.6.2 *has been deleted*.

Table 17.6.3 *has been deleted*.

Table 17.6.4 *has been deleted*.

~~*6.1.2* Piping systems are to be constructed in accor-~~dance with approved plans and specifications.

6.1.3 Pipe welding may be performed using manual, semi-automatic or fully automatic electric arc welding processes. The use of oxy-acetylene welding will be limited to Class 3 pipework in carbon steel material that is not carrying flammable fluids and limited to butt joints in pipes not exceeding 100 mm diameter or 9,5 mm wall thickness.

6.1.4 Where pressure pipework is assembled and butt welded *in situ*, the piping is to be arranged well clear of adjacent structures to allow sufficient access for preheating, ~~welding, heat treatment and examination of the joints.~~

Existing sub-Section 6.2 *has been deleted*.

Existing sub-Section 6.3 *has been renumbered* 5.2*.*

~~6.3~~ 5.2 Welding workmanship

~~*6.3.1* Welding procedures are to be established for~~ welding of pipework including attachment welds directly to pressure retaining parts and are to be qualified by testing on simulated joints.

6.3.2 Where the work requires a significant number of branch connections, tests may also be required to demonstrate that the type of joint(s) and welding techniques employed are capable of achieving the required quality.

6.3.3 Welding consumables and, where used, fusible ~~root inserts, are to be suitable for the materials being joined.~~

~~*6.3.4* For welding of carbon and low alloy steels, preheat is to be applied depending on the material grade, thickness and hydrogen grading of the welding consumable in accordance with Table 17.6.2 unless welding procedure testing indicates that higher levels are required.~~

~~*6.3.5*~~ *5.2.1* Preheating is to be effected by a method which ensures uniformity of temperature at the joint. The method of heating and the means adopted for temperature control are to be to the satisfaction of the Surveyors.

~~*6.3.6*~~ *5.2.2* All welding is to be performed in accordance with the approved welding procedures (*see* 6.3.1) by welders who are qualified for the materials, joint types and welding processes employed.

~~*6.3.7*~~ *5.2.3* Welding without filler metal is generally not permitted for welding of duplex stainless steel materials.

~~*6.3.8*~~ *5.2.4* All welds in high pressure and high temperature pipelines are to have a smooth surface finish and even contour; if necessary, they are to be made smooth by grinding.

~~*6.3.9*~~ *5.2.5* Check tests of the quality of the welding are to be carried out periodically at the discretion of the Surveyors.

Existing sub-Section 6.4 *has been deleted*.

Existing sub-Section 6.5 *has been deleted*.

■ *Section ~~7~~ 6*
Non-Destructive Examination

Existing **Section 7** *has been renumbered* **Section 6**.

~~7.1~~ 6.1 General

~~*7.1.1*~~ *6.1.1* ~~Non-Destructive Examinations (NDE) of pressure vessel welds are to be carried out in accordance with a nationally recognized code or standard~~. Non-Destructive Examination (NDE) of pressure vessels is to be performed in accordance with the requirements of Ch 13,5 of the Rules for Materials.

~~*7.1.2* NDE should not be applied until an interval of at least 48 hours has elapsed since the completion of welding.~~

Existing sub-Section 7.2 *has been deleted*.

Existing sub-Section 7.3 *has been deleted*.

Existing sub-Section 7.4 *has been deleted*.

Existing sub-Section 7.5 *has been deleted*.

Existing sub-Section 7.6 *has been deleted*.

Existing sub-Section 7.7 *has been deleted*.

Part 7, Chapter 9
Navigational Arrangements for Periodic One Man Watch

CORRIGENDA

■ *Section 5*
Integrated Bridge Navigation System – IBS notation

5.5 Alarm management

5.5.7 The following alarms are not to be grouped:

- Emergency alarms.
- ~~Seperate~~ Separate group alarms associated with faults requiring speed or power reduction or the automatic shutdown of propulsion machinery.
- Steering gear alarms.

■ *Section 6*
Trials

6.1 General

6.1.2 For **IBS** Notation, testing at the manufacturer's works and trials on board are to be carried out that cover the individual components and their interaction; and the bridge functions and their integration to form the Integrated Bridge System.

Section numbering in brackets reflects any Section renumbering necessitated by any of the Notices that update the current version of the Rules for Ships.

Part 3, Chapter 10

1.1.3	*Reference* 2.9 to 2.13 *now reads* 2.5 to 2.9.
Table 10.2.1(6)	*Reference* 2.6.7 *now reads* 2.2.5.
Table 10.2.1, Note 5	*Reference* 2.6.7 *now reads* 2.2.5.
Table 10.2.5, Note 2	*Reference* 2.6.11 *now reads* 2.2.8.
Table 10.2.6	*Reference* 2.13.15 *now reads* 2.9.3.
5.2.11	*Reference* 2.13 *now reads* 2.9.

Part 4, Chapter 8

4.7.2	*Reference* Pt 3, Ch 10,2.10.3 *now reads* Ch 13,2.2.2 of the Rules for Materials.

Part 5, Chapter 3

3.2.7 (Existing)	*Reference* Ch 17,8.2 *now reads* Ch 17,4.

Part 5, Chapter 17

1.1.3	*Reference* Section 6 *now reads* Section 5.
6.3.6 (Existing)	*Reference* 6.3.1 *now reads* Section 5

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